

## SECTION J.3.2

### SAFETY BASIS DOCUMENTATION

#### J.3.2 Safety Basis Documentation

A Safety Basis is the combination of information relating to the control of hazards at a nuclear facility (including design, engineering analysis, and administrative controls), upon which the DOE depends for its conclusion that activities at the facility can be conducted safely. While the Fernald site is considered a nonreactor nuclear facility, each project is further categorized, following the criteria set forth in DOE-EM-STD-5502-94, "Hazard Baseline Documentation." This hazard categorization determines the documentation required to adequately assess the hazards associated with the activities planned. This documentation can range from a full seventeen-chapter SAR, requiring DOE-OH approval, to a safety assessment, which is FDF reviewed and approved. The Safety Basis is critically linked to the design of new facilities. DOE-OH is the regulatory approval authority for Nuclear Safety documentation for HC-3 and above nuclear facilities at the FEMP. DOE-Ohio may delegate that approval to DOE-FEMP.

The HC is also used to trigger, and set the level of effort for, other FDF programs such as ORR, CONOPS, and PAAA Quality Assurance reporting.

A HC is primarily inventory driven, although the DOE may request a higher HC designation be applied if there are extenuating circumstances, such as new technology.

The Contractor shall perform hazard categorization per the requirements of FDF document NS-0003 "Safety Assessment Hazard Screening and Classification," (Attachment J.4.79) and DOE-EM-STD-5502-94 for the activities associated with the remediation of the Silo 3 waste.

##### J.3.2.1 Segmentation

The Contractor may address the entire operation as one segment with one safety basis document or can attempt to segment the activities. This may allow the Contractor to achieve a lower HC for a given segment.

An activity may be considered a segment for safety analysis purposes if all the following conditions are true:

- The activities are separated by distance within a specific geographical area. (**NOTE:** At a minimum this distance will be 30 meters. This may increase based on the energy sources added by the operation).
- The activities contained within the specific geographical area are discrete. Examples include, but are not limited to: construction of the waste processing facility and operation of the waste processing facility; and

- An accident or event in one segment cannot directly impact another segment (excluding natural phenomena such as earthquake and high winds).

For the Contractor to take credit for segmentation, the Contractor shall document that two out of three of these conditions for segmentation are met as part of their pre-award proposal. The Contractor shall document that all these conditions are met as part of the post-award safety assessment as described in Attachment J.3.2, Section J.3.2.3.2.4.

### **J.3.2.2 Hazard Category**

The Contractor shall design, construct, operate, and decontaminate and dismantle the remediation facility within the criteria as defined by DOE-STD-1027-92 and DOE-EM-STD-5502-94. The Contractor shall adhere to the requirements of RM-2116 and follow NS-0003 to determine the appropriate hazard category and safety documentation requirements for the facility.

The HC for this operation will be determined based on the inventory of materials involved in the operation that are listed in DOE-STD-1027-92 and 40 CFR Part 302 and the ability of that material to become airborne. Factors that have the greatest impact on HC determination include:

- Size, location, and constituents of concern (COC) (both radiological and chemical) in inventory either in tanks awaiting processing, material in process, or processed material awaiting storage or shipment;
- Physical properties of the material, such as form, moisture content, and particle size; and
- Energy sources that could disperse the waste in inventory.

FDF has designated Silo 3 as a HC-3 nuclear facility. The current safety basis for Silo 3 is the Basis for Interim Operations (BIOs) PL-3049 Appendix L (Attachment J.4.62). The hazard categorization of the process facility for the stabilization of Silo 3 material will be driven by the ability of the Contractor to use segmentation and define the maximum releasable inventory of waste within any segment of the process at any given time.

#### **J.3.2.2.1 Methodology**

The Contractor shall designate a Safety Analysis Team Leader. This person shall coordinate the development of the required safety basis documents and provide interface to FDF as to the status of the required Safety Basis documents. This person shall complete the FDF required training for a Technically Responsible individual (TR) and the Qualified Safety Evaluator (QSE). If a SAR or a Hazard Analysis Report (HAR) is required, this person shall perform the Unreviewed Safety Questions (USQ) screens in accordance with NS-0002, Unreviewed Safety Question and Safety Evaluation System Attachment (J.4.42).

If a SAR or a HAR is required, FDF will perform the USQ Safety Evaluation for any screen that is determined to be a possible USQ. The Contractor shall support FDF in the Safety Evaluation by providing calculations and analysis, as necessary.

The current HAR (Attachment J.4.62) for OU4 addresses retrieval. The Contractor shall perform a Hazard Analysis for the retrieval design in accordance with Section J.3.2.3. The hazard analysis, including recommended changes to all chapters of the HAR for OU4, shall be submitted with a USQ screen for FDF to perform the USQ Safety Evaluation. Upon approval of the USQ, the current Safety Basis will cover the retrieval segment of the facility. The Contractor shall develop the Safety Basis in accordance with this section for all other segments.

### **J.3.2.3 Safety Basis Documentation Submittals**

There are three phases for the HC/Safety Basis documentation submittals:

#### **! Pre-award with Proposal**

The Contractor shall produce a preliminary hazard analysis (PHA) for each of the project segments. Along with the PHA, the Contractor shall determine the preliminary HC for the identified project segments using the supplied data for Silo 3 and submit the supporting HC calculations with the PHA for each segment.

The Contractor shall submit a Safety Basis Documentation Implementation Plan. The content and format are described in Section J.3.2.3.2.1.

#### **! Pre-mobilization**

The Contractor shall submit the draft Safety Basis documents as specified in Table J.3.2-2 for each segment of the operation for FDF review and approval. Safety basis documentation shall be updated as indicated in Table J.3.2-2. These updates shall be forwarded to FDF for review and approval as part of the mobilization/construction work package. Approval of the final Safety Basis documents is required for authorization to mobilize.

Depending on the hazard classification and the complexity of the operation, further hazard analysis [e.g., Hazard and Operability Analysis (HAZOP), What-if, etc.] may be required. The Contractor shall use the guidelines of DOE-STD-1027-92 and DOE Guide 440.1-1 to determine the depth of hazard analysis required for the identified activities. At a minimum, an Integrated Hazard Analysis, Human Factors Evaluation, Fire Hazards Analyses and an ALARA Analysis (J.3.4) shall be performed and the results incorporated into the Safety Basis.

The Integrated Hazard analysis team shall consist of FDF and Contractor employees. An Integrated Hazardous Analysis team shall have representation from all disciplines involved in the activity and should address all hazards identified for the activities. A

copy of the final documentation shall be forwarded to FDF for inclusion in the project Administrative Record. The Contractor shall include the Integrated Hazard Analysis in the overall project schedule.

The ALARA analysis should focus on exposure points to the workers, co-located workers and the public. The analysis shall be used to support the Occupational ALARA Plan identified in Section J.3.4.2.1 of the Request for Proposal and the Safety Basis for the project.

A Human Factors Evaluation shall be performed. The evaluation should focus on addressing the issues associated with the new facilities and shall include an evaluation of the existing Human Factors Evaluation for OU4. The results of the Human Factors Evaluation shall be incorporated in the Safety Basis.

A Fire Hazards Analyses (FHA) shall be performed and meet the requirements of DOE Order 420.1 and DOE Order 440.1. Examples of facilities for which an FHA shall be performed are nuclear and high-hazard facilities, buildings in which significant quantities of hazardous materials are stored or processed, and structures featuring equipment of considerable value. Examples of facilities not generally requiring an FHA include small utility buildings, trailers, and office buildings. The FHA shall contain, at a minimum, the elements identified in the Implementation Guide for use with DOE Orders 420.1 and 440.1. The results of the FHA shall be incorporated in the Safety Basis.

Guidelines for hazard analysis techniques can be found in "Guidelines for Hazard Evaluation Procedures," Second Edition, Center for Chemical Process Safety.

As part of the 50 percent, and final submittal package all design changes from the previous reviewed and approved submittals shall be evaluated against the draft safety basis and the evaluation included in the Safety Assessment submittal.

Approval of the Safety Basis documents [Preliminary Safety Analysis Report (PSAR), HAR, Auditable Safety Record (ASR)] is required for authorization to mobilize. Once the Safety Basis documents are approved and authorization to mobilize has been received, all design changes shall be evaluated. For a HC-3 nuclear facility the evaluation shall be performed using the USQ process. In addition to the design change submittals to FDF Engineering, the design change with a USQ screen shall be submitted to FDF Safety Analysis for the USQ safety evaluation.

The Contractor shall coordinate land use with FDF Silo 3 Project Health and Safety representative prior to finalization of land use. Failure to do so could present an unreviewed safety question, thus invalidating the project's (Waste Pit Remedial Action Project and Silo 3 Project) safety basis.

! Operations/Frequency to be Determined

The HC is primarily inventory-driven. Therefore, since the processing inventory is expected to change, based on operating requirements, the Contractor shall periodically verify the HC classification for each identified segment. The frequency with which this verification is performed is dependent upon the final design and operating plan(s). Therefore, the Contractor shall propose the method and frequency for this verification as part of the proposal schedule submittal and finalize after the final design is approved. The tables and worksheets used to prepare the hazard calculations may be used for this purpose. The Contractor has the option to propose an alternative.

The Contractor shall include in the pre-mobilization submittal, its proposal for incorporating into the approved safety assessment, changes in the operational basis used to establish the HC and start-up of the facility after a prolonged shut-down. The proposed changes in the operational basis shall be submitted to FDF for review and approval prior to initiation of these changes.

#### **J.3.2.3.1 Submittal Schedule**

Refer to Tables J.3.2-2 through J.3.2-7 for specific submittal requirements.

#### **J.3.2.3.2 Documentation Requirements**

Safety Basis documentation shall be prepared using a graded approach, which keeps the rigor and depth of defense for each assessment in proportion to the hazards present. The Contractor shall provide a Safety Basis Documentation Implementation Plan which identifies the facility segments and proposes the level of Safety Basis documentation to be prepared for each.

##### **J.3.2.3.2.1 Safety Basis Documentation Implementation Plan**

At a minimum, the following information shall be provided in the Safety Basis Documentation Implementation Plan:

- ! Identification and basic description of the segments;
- ! Preliminary site plan indicating the segment locations with respect to each other and at least two FEMP landmarks;
- ! Preliminary process block diagram;
- ! Level of safety basis documentation proposed for each segment. At a minimum a, preliminary hazard assessments and hazard category calculations (Sections J.3.2.3.2.2 and J.3.2.3.2.3) must be provided; and
- ! Schedule (incorporated into the project schedule) for each segment and completion of documentation proposed for each segment with review and approval times for FDF personnel including Silo 3 Project Team, Safety Analysis Team, Independent Safety Review Committee, and DOE personnel.

##### **J.3.2.3.2.2 PHA for Each Identified Segment**

At a minimum, the following information shall be provided with these assessments:

- Identification of facility, process, or operational segments;
- Identification of the tasks and subtasks involved;
- PHA tables shall be prepared for each task and subtask in a format similar to the attached sample table (Table J.3.2-1). PHA evaluation parameters are:
  - Item Number
  - Potential Hazard/Bounding accidents
  - Cause(s)
  - Protection/Mitigative Systems
  - Consequences
  - Frequency of Occurrence
  - Ranking
  - Action Item/Comment

NS-0003, Safety Assessment Hazard Screening and Classification, will be used as a guideline for estimation of frequency of occurrence and ranking of potential hazards;

- Text executive summary of the PHA; and
- Text conclusion of the PHA, which identifies items of concern or major concerns based on their ranking and how these concerns are to be resolved (e.g., project procedure, health and safety plan provisions, or recommended process redesign).

#### **J.3.2.3.2.3 Hazard Category Calculations for Each Identified Segment**

At a minimum, the following information shall be provided with these calculations:

- Identification of facility, process, or operational segments;
- Identification of chemical inventories and concentrations, and radiological inventory by isotope, including progeny;
- Identification of bounding accidents from PHA;
- Determination of HC-3 threshold limits;
- Identification of equations, methodology, and computer models used;
- One annotated completed calculation example for each bounding accident, which, at a minimum, shall include:

- The equations used and the source of those equations;
  - Definition of the individual equation parameters [e.g., Airborne Release Fraction (ARF), which is unitless];
  - Input values to the individual equation parameters; and
  - Text describing the accident.
- Summary table listing the "potentially releasable inventory," as defined in DOE-STD-1027-92 for each segment, and accident;
  - Summary chart or diagram showing the "potentially releasable inventory" for each segment, and accident with respect to HC-3 thresholds, 40 CFR Part 302, Appendix B levels, and 40 CFR Part 302 Table 302.4 levels;
  - Radiological dose estimates shall be determined for workers, colocated workers, and off-site populations. The dose estimates shall be plotted on a summary chart or diagram showing their relationship with the associated FEMP administrative limits. At a minimum, Total Effective Dose Equivalents (TEDE) shall be provided for the following:
    - Workers and colocated workers 30 m and 100 m from the analyzed accident;
    - Workers and colocated workers in the nearest regularly occupied building or work area. FDF will provide location for these workers after the first draft equipment or facility layouts are issued by the Contractor; and
    - The maximally exposed individual (MEI).
  - Text executive summary of the HC calculation results.

#### **J.3.2.3.2.4 Safety Assessment for Each Identified Segment**

This document will provide an overall compilation of all Safety Basis Analyses. At a minimum, this assessment will include the following sections:

- Purpose
- Description of the facility, process, or operational segments. Suggested subsections include:
  - Identification of facility, process, or operational segments;
  - Text description of the facility, process, or operation under assessment;
  - Block flow diagram of the facility, process, or operation under assessment; and
  - General arrangement or site area plans.
- Summary and hazard classification/category. Suggested contents include:
  - Identification of evaluation basis parameters used to determine HC;

- Summary of the HC calculation results for the facility, process, or operational segment being assessed; and
- Summary of the required level of new documentation required, the appropriate level of approval, and any interaction with DOE in defining the documentation requirement and/or the level of approval.
- Preliminary Hazard Assessment. Suggested PHA contents include:
  - Summary of the PHA results for the facility, process, or operational segment being assessed.
- Radiological Hazards. Suggested contents include:
  - Identification of all radiological hazards;
  - Summary and discussion of the radiological HC calculations; and
  - Summary and discussion of estimated radiological doses to workers, colocated workers, and off-site populations determined in the HC calculations for the facility, process, or operational segment being assessed.
- Nonradiological Hazards. Suggested contents include:
  - Identification of all nonradiological (i.e., chemical or biological) hazards; and
  - Summary and discussion of the nonradiological HC calculations.
- Industrial Hazards. Suggested contents include:
  - Identify all standard and nonstandard industrial hazards; and
  - Summary and discussion of the PHA conclusions for the facility, process, or operational segment being assessed.
- Conclusions. Suggested contents include:
  - Summary of HC calculations;
  - Summary of PHA conclusions; and
  - Additional safety basis documentation requirements based on DOE-EM-STD-5502-94, Hazard Baseline Documentation.
- Commitments. Suggested contents include:
  - Identification of situations that could change the evaluation basis parameters;
  - Identification of actions that the Contractor shall take to ensure these situations will be detected before the evaluation basis is impacted; and
  - Identification of actions that the Contractor shall take to ensure that the existing



evaluation basis is maintained.

- References

#### **J.3.2.3.2.5 Additional Safety Basis Documents**

In addition to the Safety Assessment the following Safety Basis documents may apply:

- Safety Basis Document for each segment [PSAR, Safety Analysis Report (SAR), HAR, ASR and/or Safety Assessment) for each segment;
  - A PSAR is required for design, construction, and testing of a new HC 3 nuclear facility, which is the current HC for Silo 3. The PSAR shall be developed using the guidelines of site procedure NS-0005, Safety Analysis Reports and Technical Safety Requirements (Attachment J.4.42) and DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports. A PSAR requires FDF and DOE approval. Once approval is received, implementation of the USQ process is required;
  - A SAR is required for a HC-3 nuclear facility. The SAR shall be developed from the PSAR and using the guidelines of site procedure NS-0005, Safety Analysis Reports and Technical Safety Requirements (Attachment J.4.42) and DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Non Reactor Nuclear Facility Safety Analysis Reports. A SAR requires FDF and DOE approval and requires implementation of the USQ process, NS-0002, Unreviewed Safety Question Determination and Safety Evaluation System (Attachment J.4.42).
  - A HAR is a graded SAR. A HAR is required for a HC-3 facility when it is determined that a graded SAR can be applied. It does not require the full seventeen chapters of a SAR. A HAR requires FDF and DOE approval and requires implementation of the USQ process, NS-0002.
  - An ASR is required for facilities meeting the thresholds for a Radiological Facility and requires FDF approval.
  - A Safety Assessment is required for all new activities at the FEMP and is the first step for all levels of safety documentation.

The following are documents that shall be used in the development of the Safety Basis Documentation:

- DOE-EM-STD-5502-94, Hazard Baseline Documentation;

- DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports;
- DOE-STD-3005-YR PROPOSED, Evaluation Guidelines for Accident Analysis of Safety Structures, Systems, and Components;
- DOE-STD-3009-94, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports; and
- NS-0002, Unreviewed Safety Question and Safety Evaluation System
- NS-0003, Safety Assessment Hazard Screening and Classification;
- NS-0004, Auditable Safety Record;
- NS-0005, Safety Analysis Reports and Technical Safety Requirements;
- Guidelines for Hazard Evaluation Procedures, second edition, Center for Chemical Process Safety;
- DOE Order 5480.21, Unreviewed Safety Question;
- DOE Order 5480.22, Technical Safety Requirements; and
- DOE Order 5480.23, Nuclear Safety Analysis Reports.

**(END OF PAGE)**

### Table J.3.2-1

[illegible]